

GREENSAND^{plus}™

Performance Media for Water Filtration*

GreensandPlus™ is a black filter media used for removing soluble iron, manganese, hydrogen sulfide, arsenic and radium from water supplies.

The manganese dioxide coated surface of GreensandPlus acts as a catalyst in the oxidation reduction reaction of iron and manganese.

The silica sand core of GreensandPlus allows it to withstand operating conditions in waters that are low in silica, TDS and hardness. When using GreensandPlus, you can eliminate the aluminate feed.

GreensandPlus is effective at higher operating temperatures and higher differential pressures than ordinary manganese greensand. Tolerance to higher differential pressure can provide for longer run times between backwashes and a greater margin of safety.

Systems may be designed using either vertical or horizontal pressure filters, as well as open gravity filters.

GreensandPlus is a proven technology for iron, manganese, arsenic, radium and hydrogen sulfide removal. Unlike in-situ treated media,

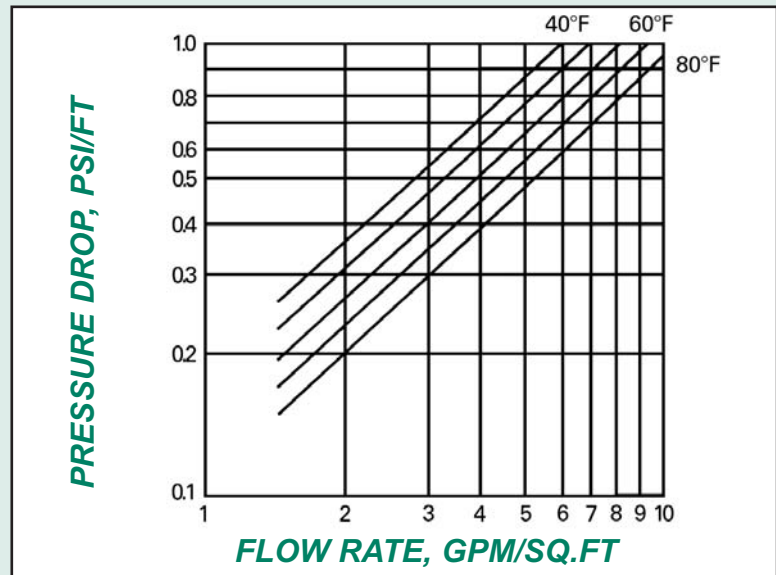
there is no need for extensive preconditioning of filter media or lengthy startup periods, during which required water quality may not be met.

GreensandPlus is an exact replacement for manganese greensand. It can be used in CR or IR applications and

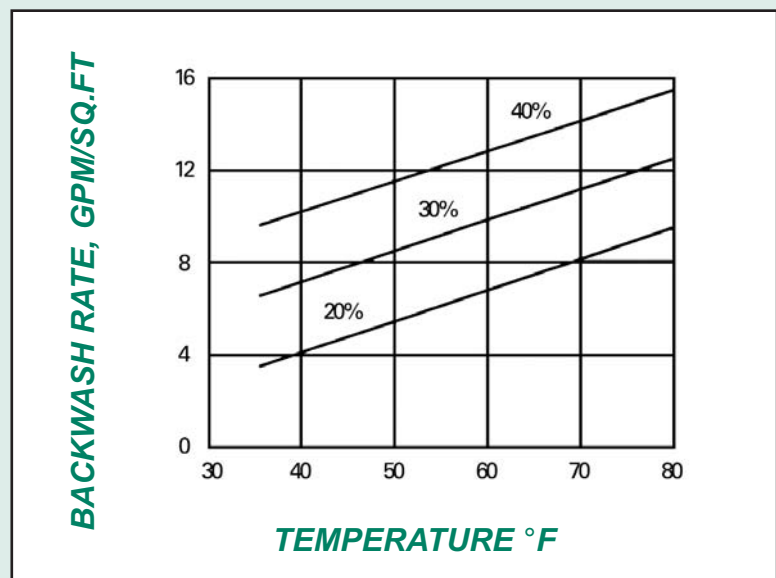
requires no changes in backwash rate or times or chemical feeds.

GreensandPlus has the WQA Gold Seal Certification for compliance with NSF/ANSI 61. Packaging is available in 1/2 cubic foot bags or 1 metric ton (2,205 lbs) bulk sacks.

PRESSURE DROP (CLEAN BED)



BED EXPANSION DURING BACKWASHING



PHYSICAL CHARACTERISTICS

Physical form

Black, nodular granules
shipped in a dry form

Apparent density

85 pounds per cubic foot net (1362 kg/m³ net)

Shipping weight

89 pounds per cubic foot gross (1426 kg/m³ net)

Specific gravity

Approximately 2.4

Porosity

Approximately 0.45

Screen grading (dry)

18 X 60 mesh

Effective size

0.30 to 0.35 mm

Uniformity coefficient

Less than 1.60

pH range

6.2-8.5 (see General Notes)

Maximum temperature

No limit

Backwash rate

Minimum 12 gpm/sq. ft. at 55°F (30 m/hr at 13°C)

Service flow rate

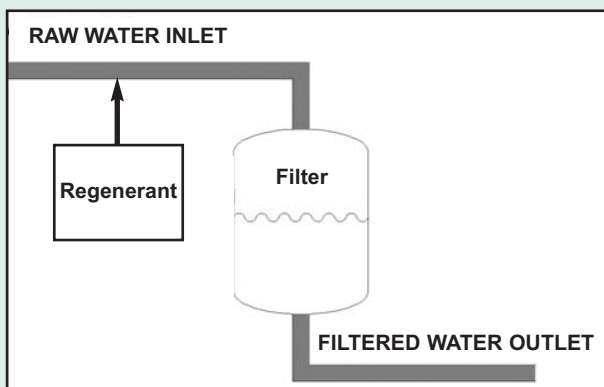
2 – 5 gpm/sq. ft. (5-12 m/hr)

Minimum bed depth

24 inches (0.6 m) 15 -18 in. (0.4 - 0.45 m) of
each media for dual media beds

METHOD OF OPERATION CR

GreensandPlus: Continuous Regeneration (CR)



Continuous regeneration (CR) operation is recommended in applications where iron removal is the main objective in well waters with or without the presence of manganese. This method involves the feeding of a predetermined amount of chlorine (Cl₂) and/or potassium permanganate (KMnO₄), directly to the raw water before the GreensandPlus Filter.

Chlorine should be fed at least 10-20 seconds upstream of the KMnO₄, or as far upstream as possible to insure adequate contact time. KMnO₄, if required, should be fed to produce a “just pink” color in the filter inlet. This slight excess of KMnO₄ or a Cl₂ residual carried through the filter will maintain GreensandPlus in a continuously regenerated condition.

The dosage of Cl₂ and KMnO₄ may be estimated as follows:

$$\begin{aligned} \text{mg/L Cl}_2 &= \text{mg/L Fe} \\ \text{mg/L KMnO}_4 &= (0.2 \times \text{mg/L Fe}) + (2 \times \text{mg/L Mn}) \end{aligned}$$

For operation using only Cl₂ the demand can be estimated as follows:

$$\text{mg/L Cl}_2 = (1 \times \text{mg/L Fe}) + (3 \times \text{mg/L Mn})$$

SUGGESTED OPERATING CONDITIONS

Bed Type

Dual media: anthracite 15-36 in. (0.4-0.9 m) and GreensandPlus 15-24 in. (0.4-0.6 m)

Capacity

700-1200 grains of oxidized iron and manganese/sq.ft. of bed area (490-840 g/m²) based on oxidant demand and operation to iron break through.

Backwash

Sufficient rate using treated water to produce 40% bed expansion.

Air/Water Scour

Optional using 0.8-2.0 cfm/sq. ft. (15-37 m/hr) with a simultaneous treated water backwash at 4.0-4.5 gpm/sq. ft. (10-11 m/hr).

Raw Water Rinse

At normal service flow rate for 3-5 minutes or until effluent is acceptable.

Flow Rate

Recommended flow rates with CR operation are 2-5 gpm/sq. ft. (5-12 m/hr). Extremely high concentrations of iron and manganese

Flow Rate (Cont.)

usually require lower flow rates for equivalent run lengths. Higher flow rates can be considered with very low concentrations of iron and manganese. For optimum design parameters, pilot plant testing is recommended. The run length between backwashes can be estimated as follows:

What is the run length for a water containing 1.7 mg/L iron and 0.3 mg/L manganese at a 4 gpm/sq. ft. (10 m/hr) operating rate?

$$\begin{aligned} \text{KMnO}_4 \text{ demand} &= (1 \times \text{mg/L Fe}) + (2 \times \text{mg/L Mn}) \\ &= (1 \times 1.7) + (2 \times 0.3) \\ &= (2.3 \text{ mg/L or } 2.3/17.1 = 0.13 \\ &\text{grains/gal. (gpg) (2.3 g/m}^3) \end{aligned}$$

$$\begin{aligned} \text{At } 1,000 \text{ grains / sq. ft. loading (700 g/m}^2) \div \\ 0.13 \text{ gpg (2.3g/m}^3) &= 7,692 \text{ gal./sq. ft.} \\ &= (304.35 \text{ m}^3/\text{m}^2) \end{aligned}$$

$$\begin{aligned} \text{At } 4 \text{ gpm / sq. ft. (10 m/hr) service rate:} \\ 7,692 \div 4 \text{ (304.35 m}^3/\text{m}^2 \div 10 \text{ m/hr)} &= 1,923 \\ \text{min.} \end{aligned}$$

The backwash frequency is approximately every 30-36 hours of actual operation.

The Intermittent regeneration (IR) operation is available for certain applications. Contact your Inversand representative for additional information.

GENERAL NOTES

pH

Raw waters having natural pH of 6.2 or above can be filtered through GreensandPlus without pH correction. Raw waters with a pH lower than 6.2 should be pH-corrected to 6.5-6.8 before filtration. Additional alkali should be added following the filters if a pH higher than

6.5-6.8 is desired in the treated water. This prevents the possible adverse reaction and formation of a colloidal precipitate that sometimes occurs with iron and alkali at a pH above 6.8.

Removing Fines and Initial Conditioning

Prior to placing the anthracite in the filter or placing the filter into service, GreensandPlus should be thoroughly backwashed and the top layer of fine material removed by undercutting in accordance with AWWA B 100, paragraph 4.5.2. This is especially important if anthracite is placed on top of the GreensandPlus bed. Each cubic foot of GreensandPlus shipped contains sufficient material to compensate for the removal of this final material.

GreensandPlus is NOT shipped in a regenerated form; therefore it is necessary, prior to use, to regenerate it contacting the bed for a minimum of 4 hours.

REFERENCES

USA

San Jacinto, CA
City of Goshen, IN
City of Burlington, MA
Raynham Center, MA
Dedham Water Co., MA
Fort Dix, NJ
Jackson Twp. MUA, NJ
Churchill County, NV
Nelson Co. Norton, OH
Alamo Water, San Antonio, TX
City of Prosser, WA

A regeneration level of 4 ounces of $KMnO_4$ or chlorine per cubic foot of GreensandPlus is recommended. Before placing into service, the filter must be rinsed of all remaining traces of potassium permanganate.

Radium and Arsenic Removal Using GreensandPlus

The GreensandPlus CR process has been found to be successful in removing radium and arsenic from well water. This occurs via adsorption onto the manganese and/or iron precipitates that are formed. For radium removal, soluble manganese must be present in or added to the raw water for removal to occur. Arsenic removal requires iron to be present in or added to the raw water to accomplish removal. Pilot plant testing is recommended in either case.

International

Riversands, Queensland, Australia
MacDonald & Fils, Montreal, Canada
Sydney, Nova Scotia, Canada
PT Aneka Bina, Jakarta, Indonesia
PT Jawa Indah Sejahtera, Indonesia
Ecofilter Technology, Amsterdam, The Netherlands
BWT Group, Warsaw, Poland
Aquatrol, Moscow, Russia
Brenntag, Froevi, Sweden
Minh Tam, Ho Chi Minh, Vietnam



GreensandPlus
magnification: 50X



The manufacturing of GreensandPlus is an ongoing, 24/7 process to ensure the highest quality water treatment media.

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